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ON THE ÆTIOLOGY OF DEFLECTIONS OF THE NASAL SEPTUM.*

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DEFLECTIONS of the septum, one of the most common conditions of nasal deformity seen at the present day, have been recognized more or less intelligently for many years. Comparing, however, the accessions of knowledge made during the past decade with the amount formerly known of them, we are forced to believe that a new era in their history has been opened, and that the full recognition of their nature and pathological significance has been fairly established.

With regard to their ætiology, however, much obscurity exists, and while this department of knowledge concerning them is full of interest and importance, it is only possible to find here and there a reliable suggestion regarding it. It has seemed well, therefore, to gather together in one article some of the scattered views upon the subject already advanced, and to bring forward at the same time certain observations and deductions which, in the course of a somewhat careful survey, have occurred to the writer.

And first, as introductory to the main topic and calculated to throw light upon many of its phenomena, it will be well to consider hastily some of the factors concerned in the development of the special and accessory structures which together compose the nasal organ, and to study their possible influence upon the abnormal conditions with which we have to deal. Watson tells us that in the infant the nasal fossæ are relatively smaller in size and much less complex than in the adult, their vertical diameter being remarkably small, the sinuses being not yet formed, and the lateral masses of the ethmoid being still cartilaginous. The cribriform plate of the ethmoid at birth is a mere membranous plane, continuous with the

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falx cerebri of the dura mater, and attached behind to the partially ossified body of the sphenoid. The vertical plate of the ethmoid, in other words, is cartilaginous at this period, while the vomer is already ossified. Some months after birth the nasal fossæ extend in all their diameters, and the different sinuses are developed. At the age of two years the frontal sinuses and ethmoidal cells have begun to form, simultaneously with the hollowing out of the antrum of Highmore.

This late development of the central portions of the skull provides not only for a certain amount of mobility in the bones during parturition, but, what is of no less importance, enables the alteration in bulk of the surrounding bones and cavities in the process of growth to go on without any rigid impediment in the center, and the full development of the soft tissues, and especially of the nerves, is possible without the risk of compression by the encroachment of bony deposits in the channels for their transmission.

From what has been said it is plain that, in the history of the development of the nose in the infant, the septum is one of the last parts to assume its ultimate form. Indeed, Zuckerkandl maintains that during this formative period it is always straight, and that deflections do not occur until the seventh year. This latter view, from clinical observation, the writer is inclined to doubt.

Again, the turbinated bones are not formed until a late period in the development of the fœtus, the inferior turbinated bone being ossified from a single center, which only appears at birth (Quain).

It follows, naturally, that the tardy development of these parts is succeeded later in the history of the individual by a very considerable activity of growth.

Finally, it will appear that: (*a*) There is an inequality of development at the outset, the vomer being ossified while the perpendicular plate of the ethmoid is still membranous, and the turbinated bones practically yet unformed. (*b*) That the process of development goes on with great rapidity at certain periods after birth. (*c*) That any considerable condition of development is not probable before the age of seven years. (*d*) Again, the posterior free border of the vomer, looking toward the pharynx, is, as a matter of clinical observation, almost invariably straight. This portion of the bone is also particularly thick and strong. Its vertical diameter is decidedly less than that of the more anterior part, and it is situated remote from the probability of injury. It therefore seems reasonable to suppose that the straight position is the one assumed at the outset, and that it is

maintained posteriorly by reason of the inherent strength of this part of the vomer, by its short diameter, and by its protected situation.

The anterior aspect of the vomer, for exactly contrary reasons, is liable to displacement, and, as a matter of fact, these displacements commonly exist.

These considerations all point directly to the inference that the septum—made up of several plates unequal in strength and in the power of resisting compression, uneven also in development, and, finally, incased in an unyielding cavity closed by the ethmoid above and firmly buttressed by the arch of the palate below—bends in the direction of the least resistance, and, as the process of growth goes on, overdevelopment is attended with a pushing aside of the various parts from their normal planes, and thus the production of deflection results. It is probable that many of the so-called congenital deflections may be thus explained.

The causes of deflection of the septum may be divided into two principal groups:

I. The predisposing.

II. The exciting.

The predisposing causes are:

(*a*) Race.

(*b*) Diathesis.

(*a*) One of the most important and interesting questions connected with this subject is the influence of race upon the development of the nose. That a predisposition toward certain marked characteristics of form should exist among the representatives of a given race is beyond a doubt. Thus, among the ancients, the Assyrian and the Grecian, the negro and the Roman, all presented external characteristics which were unmistakable, and which clearly identified the wearer as belonging to his own particular division of the human family. To-day, as before, the same conditions of race peculiarity prevail, the varieties of form observed among people of the same region being due, in all probability, to the general commingling of races which has occurred throughout many parts of Europe.

Nor is it in the external resemblance alone that this tendency is displayed. The general shape and arrangement of the interior framework of the nose seem to follow the example of its outer contour, and the development of deviations from the normal to occur far more commonly in certain types of man than in others.

In the course of studies made upon many thousands of specimens,

both in this country and in Europe, the writer has found several suggestive facts:

1. That among European races deflections of the septum are of common occurrence, 50 per cent. of all specimens showing a greater or less degree of deviation.

2. Of the different nationalities of Europe at the present day, the highest proportion of deformed septa is found among the Sclavonic and Hebrew races. Thus skulls of Russians, Bohemians, Poles, and Hungarians are more apt to show deflected septa than those of the Germanic, Celtic, and Norman types.

3. In the anthropological collection of the Peabody Museum at Cambridge, Mass., is a cabinet containing eighteen well-preserved specimens of skulls taken from ancient Roman tombs. Among these there is hardly a single instance in which the septum is straight, while in seven of them the degree of deflection is excessive, and far beyond that usually seen.

From this it would appear that the aquiline type of nose, as illustrated in the Sclav, the Hebrew, and the ancient Roman, is particularly apt to be associated with deflection, and there are many mechanical reasons why this statement should be true.

Strange to say, however, the type found by the writer to be freest from deformity of the septum is the American Indian, in whom the aquiline nose is characteristic. Indeed, among hundreds of specimens, it has been difficult to find a well-marked example of deflection, and, of the few discovered, the degree of deflection was generally very slight.

Again, among the Grecian type, deformities of the septum are common, and sometimes severe. These cases, as well as those of aquiline type, are often associated with a high-arched condition of the hard palate; in other words, there is in them a tendency toward the throwing upward of the palatine arch, and a corresponding projection forward of the nasal prominences of the superior maxillary bones.

The general drift of the testimony offered by anthropological collections containing a variety of types is toward the fact that, among primitive types, deformities are rare, while among types representing the highly civilized and luxurious they are of such common occurrence as to become almost the rule. The reason of this may be fairly based upon the following explanation—namely, that in the production of deflections of the septum chronic catarrhal conditions are an important factor, for we know that amid the surroundings

of a high state of civilization, or rather of an overcrowded popular tion, there flourish the very conditions of bad hygiene, lack of exercise, overfeeding, mouth-breathing, diathesis, etc., under which catarrh is most apt to occur.

A second predisposing cause of septal deflection is diathesis.

In patients suffering from the rhachitic, the strumous, the tubercular, or the syphilitic dyscrasia, deformities of the septum are common, as may be readily observed among such subjects in clinical practice.

II. The exciting causes of deflection of the septum are:

(*a*) Traumatism.

(*b*) Local malnutrition.

(*c*) Occlusion of the respiratory passages of the nose.

(*a*) *Traumatism.*—In a series of examinations made by Dr. J. W. Robertson, of Detroit, it was found that of two hundred and seventeen subjects of nasal deformity, eighty-three gave histories of injury having been received; and of the ninety-seven remaining, having no such histories, one half had received injuries in early life which had been forgotten, since many of them had dislocations of the cartilages and fractures of the nasal bones, which could only have been the results of external violence. It would appear from the foregoing that a large percentage was directly due to traumatism. As to the ages at which their deformities occurred, in a total of one hundred and sixty-one children from two to ten years old, only seven deformities existed. Four of these gave histories of injury. In a total of seventy-two children between ten and twenty, there were found twenty-two deformed noses. Of these, six gave histories of injury, while in sixteen the causes were unknown, although five had dislocation of the septum, and one had disarticulation and depression of the nasal bones. A number of these cases were not due to injury gave histories of syphilis, scrofula, or tuberculosis. It would appear, therefore, from these statistics, that a large proportion of nasal deformities manifest themselves between the ages of ten and twenty, a period of great constructive activity, either through the receipt of injuries or through improper development due to malnutrition.

(*b*) *Local malnutrition*, as was pointed out by Dr. Ingals in his paper read before this association in 1882, is an important factor in the production of deflection. It is even more influential in the formation of the bony spurs, crests, or ridges commonly found at the line of junction of the vomer with the maxillary ridge, and which may so effectually occlude the anterior nares. While it is highly

probable that such deformities often originate from injury, it can not be questioned that they are observed to increase regularly in size, under conditions of inflammation of the overlying mucous membrane and consequent supernutrition of the denser parts of the adjacent bone, until dimensions far beyond the original are attained.

Again, deviation of the septum may be associated with general asymmetry of the nasal fossæ.

Such asymmetry, although usually considered congenital, is probably, in most instances at least, due to causes occurring during the growth of the child. The view that stenosis of one nasal fossa may, through the withdrawal from that fossa of its proper nutrition, cause an inharmonious development of that one as compared with its fellow, seems, according to Ziem, to be strengthened by the results obtained by excluding the entrance of air from one nostril in young animals. In these, it has been observed, there was developed a deviation of the intermaxillary bone and of the sagittal suture toward the occluded side; also shortening of the nasal bone, frontal bone, and horizontal plate of the palate bone of the same side; flattening of the alveolar processes; reduction of the distance between the auditory canal and the alveolar process, as well as between the zygomatic arch and the supra-orbital border, and smaller size and asymmetrical position of the vascular and nerve canals on the closed side of the nose, together with inequality of the distance of the two orbits from the median line.

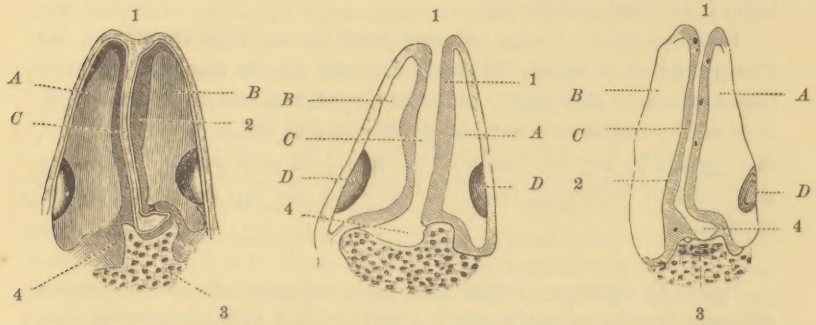
It is easy to believe that occlusion of one nasal fossa in a growing child by a large turbinated hypertrophy, unilateral hypertrophied tonsil, or adenoid growth at the pharyngeal vault, might, by depriving the occluded side of its proper nutrition, cause general asymmetry, and, with it, serious conditions of deflection.

Finally, occlusion of both nasal fossæ, from any cause, is capable of making the patient a mouth-breather. Now, one of the diagnostic signs of habitual mouth-breathing is the high-arched, narrow, hard palate, associated with which deflection is so often found. The explanation of this must lie in the fact that the septum is crowded upward by the hard palate until it can no longer resist the pressure brought to bear upon it, and deflection results. The cause of the palatal deformity seems most readily explained upon the theory of atmospheric pressure, occlusion of the nasal passages creating in them, through the act of inspiration, a partial vacuum, and thus disturbing the equilibrium of pressure upon the upper and the lower aspect of the roof of the mouth. This inequality of atmospheric

pressure, exerted during the infancy and early growth of the child, is sufficient, as seems in many cases probable, to give rise to a permanent condition of deformity of the hard palate, and thus to interfere with the normal development of the septum, which, in turn, is still further distorted by the abolition of the natural process of nasal respiration.

In addition to the more serious conditions of deflection of the bony parts there are commonly found deviations and deformities of the anterior or cartilaginous portion of the nasal septum which are sufficiently pronounced to cause discomfort and to merit attention. They are probably of traumatic origin in nearly every instance. It is not uncommon, either, for the surgeon to see recent cases of actual dislocation of the cartilaginous septum resulting from recognized causes of injury.

Some of these are well illustrated in the accompanying cuts.



Vertical sections through the cartilaginous septum in three different noses. (From Moure, after Löwenberg.)

A, vertical section of the right nasal fossa; *B*, vertical section of the left nasal fossa; *C*, section of the septum; *D*, anterior extremity of the inferior turbinated; 1, cartilage of the septum; 2, Schneiderian membrane covering both sides of the septum; 3, maxillary ridge.

These, however, are more apt to be due to the habitual bending of the tip of the nose in a given direction, as in blowing the nose with one and the same hand, and, since it is a matter of history that misshapen alæ in the young may be made straight by a process of systematic molding, there seems no reason why the converse should not be true. The last-mentioned conditions are important, and deserve more care than they have hitherto received.

From causes so diverse as those which have been herewith presented, and in an organ the size of which is considerable and the relations of which are somewhat complex, it follows that the structural deformities which may occur are greatly varied, both as to

character, position, and degree. To discuss them in detail does not come within the limit of this paper, and is besides unnecessary, since they have been well described elsewhere by other writers. It is probable that with a better understanding of the subject the special causes of the different recognized forms of deflection will be more precisely classified. At present we may hazard the following general statement:

1. That deflections of the cartilaginous septum are due, as a rule, to trauma.

2. Bony ridges along the line of suture of the septum with the superior maxillary bone are often initiated by trauma, and subsequently aggravated by hypernutrition; otherwise they are due to hypernutrition alone.

3. Deflections of the nasal septum proper may be due either to trauma or to improper nutrition. They are generally due to the latter if situated posteriorly.

In conclusion, it must suggest itself to all that variety of deformity demands variety of treatment, and that to meet the requirements of each case many different expedients must be employed. It is as impossible to relieve all of the various forms of deflection of the septum by any one method of operation as it would be to treat all fractures occurring from the ankle to the hip with one form of apparatus.

Discussion.

Dr. E. C. Morgan: I wish to express my gratitude to Dr. Delavan not only for the valuable paper which he has presented to-day, but also for the exhaustive investigations which he has made in the past regarding the question of deformities of the nasal fossæ. As to the ætiology of deflected nasal septa, I can, from a clinical standpoint, say, so far as my observation goes, I have been able in nearly every case to trace the deflected septum to traumatism. At first the history may have been somewhat obscure, but it has been cleared up by investigation. Some member of the family has been able to recall the fact that the patient at an early period of life sustained an injury to the nasal organ. Concerning the apparent immunity from deformity of the nasal septum enjoyed by uncivilized or partially civilized races, I will again say that my clinical experience with the African race in the hospitals at Washington has been large, and I have seen deflection of the nasal septum but very rarely. I have not investigated the subject from a statistical standpoint, for my attention was called to it for the first time by Dr. Delavan's paper.

Dr. F. Donaldson, Jr.: As to deflection of the nasal septum in the colored race, I had for some years a large dispensary practice among

these people, and I believe that this deformity is not so common with them as with the white race.

Dr. C. E. Sajous: So far as the ætiology of deflection of the nasal septum is concerned, I hardly think that traumatism can be clearly defined in every case, for, as Dr. Cohen says, all children get bumps on the nose. We know how elastic the end of the nose is, and the general elasticity of the nasal structures is in proportion to the youthfulness of the person. I therefore think that in trying to trace a history of traumatism we should not go back of a certain age, say seven years. Of course an exception would be made where much deformity existed which could be traced directly to a severe blow before the seventh year. With regard to the indications of treatment when there is deflection of the nose, if I find that the patient has diminished breathing capacity through the nose, that he has to breathe through the mouth, I institute treatment; but if he makes no complaint, and I see that respiration through the nose is satisfactory, I leave it alone, for those operations at best are often unsatisfactory, correction of the deformity frequently proving fruitless. With regard to the procedure to be adopted, I quite agree with Dr. Delavan that it is a mistake to try to establish a fixed measure for all cases. In one you will require the punch, in another the saw, in another the burr, and in most of them you will not require those things at all. It seldom occurs that out of twenty cases you will find any two having any resemblance whatever.

Dr. J. Solis-Cohen: This is a very obscure subject. Of course we are all very much indebted for the light which has been thrown upon it by this review of matter relating to the ætiology. While it is well known that the colored people of the South have a large admixture of the Caucasian blood, still it is true that they have large nostrils, with probably less obstruction to nasal respiration, and that would account for their having a straighter septum than white people, and would go to support the theory of the writer of the paper. The American Indians make it a point to breathe through the nose. When they sleep they sometimes place the hands over the mouth for the purpose of preventing mouth-breathing. Since my attention was directed to the subject of deformity of the palate by the articles of Dr. Jarvis and others, I have examined all my patients with regard to that point, and, while I must agree that in the majority of cases this deformity of the palate and deflection of the septum go together, I am equally positive that in a great many cases of deflection of the septum there is a fairly normal arch, and that there may be a high arch without a deflected septum. While speaking on this subject I would mention an observation which I have often made, but which, as far as I know, has not attracted the attention of others—viz., that besides the arching of the roof of the mouth there is often something which looks like an exostosis at the roof of the palate. It may be that in these cases there is a greater tuberosity, a greater outgrowth of bone, both of the superior maxillary bone and of the nasal septum. Since the statement was made that children have a vertical septum I have given attention to that point, and have

found that in a great many children the septum is deflected although they have not yet attained to the seventh year. With regard to traumatism, of course we know that nurses will drop the children, that boys will fight, and so on, and it is difficult to eliminate this factor, and it is hard to say how many cases are due to that. In conclusion, I would most emphatically state that I have seen over and over again cases in which there was marked deflection of the nasal septum, and in which there was no difficulty at all in respiration.

Dr. J. N. Mackenzie: I rise to congratulate Dr. Delavan on the admirable paper which he has given us. It is a subject in which I am very much interested myself, and which I dealt with in an elaborate manner some years ago ("Transactions of the Virginia State Medical Society,' 1883.) I wish, therefore, to make some remarks upon certain of the points which have been raised. With regard to race peculiarities, I do not recall a single case of deflection of the septum in an African in which I have been obliged to operate. Yet I see a great many Africans at my clinic in Baltimore. I have seen deflection of the septum in them, but not demanding operation. A good many factors enter into the question of race peculiarities, among which national customs may exert some influence. Among some races the nose is carefully molded during infancy. In Detroit I called attention to the custom of the ancient Persians, especially those in the higher walks of life, who molded the nose of their offspring so that the septum would be perfectly straight. No Persian was allowed to sit on the throne unless he had a perfectly straight septum and a correspondingly good-looking nose. With regard to the congenital origin of these deflections, while the positions taken by Dr. Delavan are excellent, still it seems to me not impossible that the deformity may occur during intra-uterine life. There may be some changes in development during the fœtal state which may give rise to deformity of the septum. I think that in a certain proportion of cases the suggestion made years ago by Morgagni may have some weight—namely, that the deflection may be due to the rapid growth of the septum and comparatively slow growth of the surrounding parts. The suggestion of Follin and Duplay, which has been referred to by Dr. Jarvis, regarding the influence of the development of the palatine arch, etc., may be an important one, but the great exciting cause is unquestionably traumatism. In the vast majority of cases where patients present themselves for treatment it will be found, on close inquiry, that the lesion originated in trauma. Especially is this true of deformity of the cartilaginous septum.

Dr. Delavan's remark at the close of his paper was certainly a very pertinent one. It is utterly absurd to say that one method of treatment will be efficacious in every case. The spurs which are so common in the nasal cavity are by no means always of sufficient importance to be sawed off, or pinched off, or dealt with in a very radical manner. In the majority of those cases, unless some obstructive lesion exists, I find there is very little difficulty in breathing through the nose, and I let them alone

unless there is some irritative process which may be removed by division of the spur. I think the septum is too often and too violently assailed. While in cases that require treatment I would not hesitate to perform any operation, still I think we ought to select our cases.

Dr. T. A. De Blois: There is a class of cases I have not heard spoken of—namely, the nose of the pugilist. During the past winter a number of prominent pugilists have been under my care, and my wonder has been excited that in them the septum is so little deflected. The nasal bones may have been seriously injured, and the nose itself spread all over the face, yet the septum will remain wonderfully straight. I can recall the case of a well-known man whose nose has been completely broken over and over again, yet whose septum is in a right line, and whose nasal respiration is exceedingly good. Last winter I saw a pugilist immediately after the cartilaginous septum had been separated from the bony septum. It was very easily put back into place. He had not had a deflected septum from his previous experience. What is remarkable in these cases is the immense size of the lower turbinated bones anteriorly. It seemed to me that the beating which these people get increases the size of the turbinated bones a great deal more than of the septum. I suppose these could certainly be considered traumatic cases.

Dr. J. O. Roe: The most frequent result from injury to the nose in children, in the cases which have come under my observation, is dislocation of the triangular cartilage. This is an injury which has been very slightly alluded to. In a number of instances I have seen this cartilage so dislocated as to almost completely occlude both nostrils—one by the bulging outward at the point of dislocation, and the other by the end of the cartilage being turned across it. In another class of cases we find one side of the septum straight, while the opposite nostril may be nearly occluded by a bony outgrowth along the lower portion of the septum, which gives it the appearance of being deflected. This, I think, is often due, as Dr. Bosworth has already pointed out, to exostosis along the line of the maxillary articulation, resulting from an injury during childhood, and producing at this point an arthritis. Reference has been made in this discussion to the use of the punch in the treatment of angular deflections of the septum. This is a method which I can not indorse, and which I consider very bad surgery. To remove the deformity in the septum by this method is a confession of our inability to correct it by better surgical means. The hole which is left in the septum by the punch forms a place for the collection of the secretions, which become dried into crust, and produce more or less irritation. At the point of angular deflections of the septum there is always more or less exostosis, which is thrown out as the result of the injury. This should be removed, which is best done by the nasal saw, before any attempt is made to correct the deflection.

The President: I wish to correct my record of 1882, at which time I expressed it as my belief that these changes in the position of the septum did not occur in early life, but that they made their appearance about

the age of puberty. Since that time I have had some experience leading me to modify that view. I recall two cases in which it became necessary to operate on children under two years and a half of age because the nostril was completely occluded by a deviated septum. The remarks of two of the gentlemen with reference to traumatism were very pertinent. I think that when the injury is not sufficient to fracture or dislocate the nasal bones, or to dislodge the cartilage, there is no probability that deformity will result. If the nasal bones are fractured, we can readily understand how the deformity results; if the cartilage is separated at either border, an inflammatory process will be set up which is very apt to increase its growth, and in that way cause deformity. But, if we bend the cartilage to one side or the other, it springs back as a sheet of steel would, and can not remain in the normal position.